UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/898,043	07/05/2001	Nobuhiko Hayashi	010849	2566

23850 7590 07/14/2003

ARMSTRONG,WESTERMAN & HATTORI, LLP
1725 K STREET, NW
SUITE 1000
WASHINGTON, DC 20006

EXAMINER
MONDT, JOHANNES P

ART UNIT	PAPER NUMBER
2826	

DATE MAILED: 07/14/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application N .	Applicant(s)	
	09/898,043	HAYASHI	
	Examin r	Art Unit	
	Johannes P Mondt	2826	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *22 April 2003* .

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disp sition of Claims

4)☒ Claim(s) *25-37* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *25-37* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Response to Amendment

Amendment B filed 4/22/3 and entered as Paper No. 9 forms the basis of this Office Action. In Amendment B Applicant cancelled claims 1-24. Claims 25-37 remain in the application. Applicant amended claims 25 and 29, thereby moving the further limitation concerning the ridge portion of the said cladding layer of first conductivity type from claim 29 to claim 25, thus substantially amending claims 25-28 and 30-37. Comments on Applicant's Remarks accompanying Amendment B are included below under "Response to Arguments".

Response to Arguments

1. Applicant's arguments filed 4/22/3 have been fully considered but they are not persuasive. In particular, counter to Applicant's allegation that the device by Sverdlov (6,266,355) as cited in the art rejections in the previous Office Action is not a semiconductor laser device, Sverdlov teaches a Group III-V nitride laser device (see title). Furthermore, the inclusion of the further limitation of the ridge portion in the independent claim 25 rather than in claim 29 does not place the present application in condition for allowance, because of the presence of the teaching of a ridge portion of several tens of microns of thickness in an upper cladding layer in Group III-V semiconductor light-emitting devices to increase light emission efficiency, as witnessed by Tanaka et al (cf. column 10, line 62 – column 11, line 24), - all of this having been mentioned in the previous Office Action. Applicant also is referred to any standard textbook discussion on the rationale for including said ridge portion to stabilize the

fundamental lateral mode and thus increase the light emission efficiency, as mentioned in Tanaka (loc. cit.).

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. ***Claims 25-27, 29-30 and 32-37*** are rejected under 35 U.S.C. 103(a) as being unpatentable over Sverdlov (6,266,355 B1) in view of Tanaka et al (4,961,197).

With regard to claim 25: Sverdlov (see Figure 1) teaches a nitride based semiconductor laser device (cf. title) comprising:

a light emitting layer 18/20/22 (cf. column 4, line 9 – column 5, line 19) composed of a Group III nitride based semiconductor (indium gallium nitride) (cf. title and abstract) and including an active layer 20, and a cladding layer 24 of a first conduction type (p-type) composed of a Group III nitride based semiconductor, formed on said light emitting layer, having a larger band gap than said active layer by virtue of its material constitution (GaN; the inclusion of indium in the GaN lowers the band gap energy because In has more atomic shells than Ga; see periodic system; furthermore, it is inherent in cladding layers to have a band gap energy greater than that of the active layer so as to promote absorption in the active layer rather than in the cladding layer), and having a lower refractive index than the active layer (again a necessary consequence of the material

constitution, as discussed above), the thickness of said cladding layer 24 of a first conduction type being in a range that substantially overlaps with the range of claim 25, namely between 0.1 and 0.5 μm (cf. column 5, lines 6-8).

Sverdlov does not necessarily teach the said cladding layer of first conductivity type to have a ridge portion. However, it has long been known in the art of Group III-V semiconductor light-emitting devices to include a ridge portion of several tenths of micron thickness in the upper cladding layer to increase light emission efficiency, as witnessed by *Tanaka et al* (cf. column 10, line 62 – column 11, line 24).

Motivation, to include the teaching by Tanaka et al in the invention by Sverdlov, stems from the ubiquitous advantage of increased light efficiency in laser apparatus. *Combination* of said teaching with said invention is straightforward application of the process described by Tanaka et al (cf. col. 11, lines 8-12). *Success* in implementing said combination can therefore be reasonably expected.

With regard to claim 26: the cladding layer 24 taught by Sverdlov has 0 aluminum composition ratio, which is not more than 0.05 (cf. abstract and column 4, line 58 – column 5, line 19).

With regard to claim 27: said light emitting layer as taught by Sverdlov further includes an optical guide layer of first conductivity type (p-type here) 22 for gathering electrons and holes and leading or guiding them to the active layer (cf. column 4, line 9 – column 5, line 19), and by virtue of having an indium

composition ratio that is intermediate between that of the active layer and that of the cladding layer (y>x, see column 4, line 9 – column 5, line 19), said optical guide layer of first conduction type 24 has a smaller band gap and higher refractive index than said cladding layer of first conduction type and a larger band gap and lower refractive index than said active layer, while said cladding layer is formed on said optical guide layer of a first conduction type.

With regard to claim 29: Sverdlov does not necessarily teach the further limitation defined by claim 29. However, it has long been known in the art of Group III-V semiconductor light-emitting devices to include a ridge portion of several tenths of micron thickness in the upper cladding layer to increase light emission efficiency, as witnessed by Tanaka et al (cf. column 10, line 62 – column 11, line 24). Although the ridge thickness taught by Tanaka is 0.7 μm and not 0.3 μm as required for the present claim, Applicant does not show the range defined by claim 29 to be critical to the invention. Applicant is reminded that it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or working ranges involves only routine skill in the art. In re Aller, 105 USPQ 233.

With regard to claim 30: the Group III nitride based semiconductor as taught by Sverdlov contains gallium (cf. column 2, lines 40-67).

With regard to claim 32: said active layer as taught by Sverdlov contains gallium and indium (cf. column 2, lines 40-67).

With regard to claim 33: said active layer as taught by Sverdlov has a multi-quantum well structure (cf. Figure 3 and column 4, line 64 – column 5, line 19), while inherent to the concept of multiple quantum well structure is the alternate inclusion of one or more well layers as active layers and a plurality quantum barrier layers (cf. column 4, line 65 – column 5, line 3), as a necessary logical consequence of which the band gap of the active layer is the band gap of said one or more well layers.

With regard to claim 34: it is understood in the art of semiconductor laser devices that the electric field distribution of laser light in the active layer is changed, i.e., has a time dependence, in accordance with a sine or cosine function because coherent light is activated within said active layer; and that the electric field of laser light in the cladding layer of a first conduction type is changed in accordance with an exponential function, as light is not activated but instead partly absorbed in said cladding layer. Therefore, the further limitation of claim 34 does not distinguish over the prior art.

With regard to claim 35: Sverdlov does not necessarily disclose the further limitation as defined by claim 35. However, the use of current blocking layers in the art of nitride based semiconductor laser devices for the specific purpose (motivation) to improve light emitting efficiency has long been known, as evidenced by Tanaka et al, who teach (cf. Figure 1) the nitride based semiconductor laser device to comprise a current blocking layer (cf. column 12, line 60 – column 13, line 28) formed on the upper cladding layer 5 (cf. column 12,

line 60 – column 13, line 40) and having a striped opening (cf. column 12, line 60 – column 13, line 40). Combination of the teaching by Tanaka et al with the invention by Sverdlov presents no difficulties as the layer by Tanaka et al can be standardly produced.

With regard to claim 36: the first conduction type of the cladding layer 24 of claim 25 as taught by Sverdlov is p type, as already mentioned.

With regard to claim 37: the nitride based semiconductor laser device of claim 25 as taught by Sverdlov further comprises a cladding layer 16 of second conduction type (n-type) 16 (cf. column 4, line 14) composed of a Group III nitride based semiconductor, namely GaN, said light emitting layer is formed on said cladding layer of second conduction type (cf. Figure 1).

4. ***Claim 28*** is rejected under 35 U.S.C. 103(a) as being unpatentable over Sverdlov and Tanaka et al as applied to claim 27 above, and further in view of Steigerwald (JOM, volume 49, issue 9, pp. 18-23 (1997)). Sverdlov does not necessarily teach the further limitation as defined by claim 28. However, the application of a carrier leakage preventing layer of first conductivity type formed on said active layer and having a larger band gap than said optical guide layer of first conductivity type is standard in the industry for the purpose of preventing carrier leakage, as witnessed by Steigerwald et al, who show (cf. Fig. 5) the Nichia Company's Blue Light-Emitting device with a layer formed of p-type $Al_{0.2}Ga_{0.8}N$ interposed between a multiple quantum well and the p-GaN optical guide layer. Motivation to include the teaching flows from the deleterious effects

of carrier leakage on luminous output as understood by those of ordinary skills in the art. While the inclusion of this carrier leakage prevention layer does not present any difficulty considering its close material relationship to the basic semiconductor laser materials used by Sverdlov. Therefore, it would have been obvious to one of ordinary skills in the art to modify the invention as defined by claim 27 so as to include the further limitation as defined by claim 28.

1. ***Claim 31*** is rejected under 35 U.S.C. 103(a) as being unpatentable over Sverdlov (6,266,355 B1) and Tanaka et al as applied to claim 25 and in further in view of Bour (5,812,576) and Chen et al (6,177,359 B1). As detailed above, Sverdlov anticipates claim 25. Sverdlov does not necessarily teach the further limitation defined by claim 31. However, if it were not for considerations of method of making, AlGaN (greater band gap), is preferable, as admitted by Sverdlov (cf. abstract, a/o), and the only reason Sverdlov departs from the commonly chosen structure including AlGaN cladding layers 104 and 108 as taught by Bour (cf. Figure 1) for the same device as Sverdlov, i.e., nitride based semiconductor laser with InGaN active layer (cf. title, abstract and column 1) is the avoidance of the need to apply heat that affects the underlying InGaN layers; however, as taught by Chen et al, epitaxially grown layers such as the upper AlGaN cladding layer 108 of Bour (cf. Bour, column 5, line 35), can be easily detached from the substrate and transferred to another substrate without loss of optical properties (cf. abstract, final sentence).

Motivation to include the teachings in this regard by Bour and Chen et al is the achievement of higher band gap cladding material without compromising the integrity of the underlying light-emitting layer when applied to the invention of Sverdlov. The inventions can be easily *combined*, because the method of growing the cladding layer 108 epitaxially on a separate substrate after which said cladding layer is transferred to be become layer 24 placed on top and in direct contact with layer 22 does not interfere with any of the other steps in the method of making the superior device. *Success* in implementing the combination can therefore be reasonably expected.

Conclusion

5. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Johannes P Mondt whose telephone number is 703-306-0531. The examiner can normally be reached on 8:00 - 18:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nathan J Flynn can be reached on 703-308-6601. The fax phone numbers for the organization where this application or proceeding is assigned are 703-308-7722 for regular communications and 703-308-7724 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

JPM
July 7, 2003

NATHAN J. FLYNN
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800